Estimating Emissions Using the Mass Balance Method

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Volatile Organic Compound (VOCs)?

What is a VOC?

- any compound that contains carbon

  (with some exceptions)

What is not a VOC?

40 CFR 51.100 Definitions

- carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate
- This includes any such organic compounds which have been determined to have negligible photochemical reactivity… see 40 CFR 51.100 Definitions for full list. (Attachment A)

How are VOCs Emitted?

Coatings consist of liquids and solids

- Solids are resins (binders), pigments
- Liquids are water, solvents, diluents, reducers, and thinners.

VOCs are emitted by evaporation

- Mixing
- Application
- Curing

Coatings

- Agitation
- Cleaning
- Reclaiming

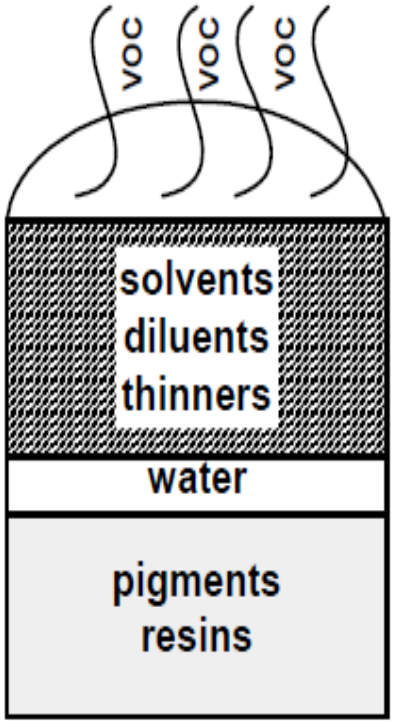
Solvents

- Blending
- Packaging

Chemical

- Refining
- Storage
- Distribution

Fueling



Mass Balance Method

Things you need to know in order to calculate emissions.

- List of the Materials Used and/or Applied;
- Actual Annual Usage;
- VOC Content by weight% or lbs/gal; and
- Control Efficiency

Types of Coatings

- Primer
- Base Coats
- Top Coat
- Clear Coats
- Undercoats/Rust Proofers
- Paint Stripper
- Cleaners/Solvents
- Reducers/Activators

SECTION D

TOTAL VOC EMISSIONS CALCULATIONS
Mass Balance Method

D1-4

Name of Material Used or Applied		Annual Usage			VOC Content	Unit (wt.% or lb/gal)	Uncontrolled Emissions				Control Efficiency (%)	Controlled Emissions			
							Actual		Potential			Actual		Potential	
		Actual (Unit/yr)	Potential (Unit/yr)	Unit (lb or gal)			lb/yr	tons/yr	lb/yr	tons/yr		lb/yr	tons/yr	lb/yr	tons/yr
Reference for Equation & Notes:		a, (1)	b, (1)	(2)	c	(2)	d	e	f	g	h, (3)	i	j	k	l
Example:	*Material X*	*5,000*	*10,000*	*gal*	*2.8*	*lb/gal*	*14,000*	*7.00*	*28,000*	*14.00*	*95*	*700*	*0.35*	*1400*	*0.70*
	Material Y	*3,000*	*7,000*	*lb*	*50*	*%*	*1,500*	*0.75*	*3,500*	*1.75*	*80*	*300*	*0.15*	*700*	*0.35*
	Total VOC						***15,500***	***7.75***	***31,500***	***15.75***		***1000***	***0.50***	***2100***	***1.05***
Total VOC (sum of emission):															

EQUATIONS:

d	= a x c for lb/gal	g	= f / 2000
d	= a x c / 100 for wt.%	i	= d – (d x (h/100))
e	= d / 2000	j	= i / 2000
f	= b x c for lb/gal	k	= f – (f x (h/100))
f	= b x c / 100 for wt.%	**l**	= k / 2000

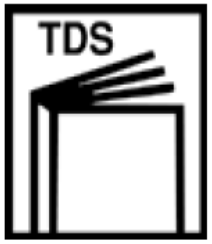
Notes:

(1) Please provide documentation for how actual usage & potential usage values were calculated

(2) If usage is reported in pounds, VOC content must be provided in % by weight. If usage is reported in gallons, VOC content must be reported in lb / gallon.

(3) Please provide information about capture efficiency and documentation for how control efficiency was determined. Attach information about retention factors and/or any assumptions made where applicable.

TECHNICAL DATA



Reduction	Up to 10% with AIR10 or AIR20	**Viscosity (sprayable) Gardener #2 Zahn Cup (ISO calibrated)**	18-20 sec
Max VOC *AIR10 OR AIR20 do not increase VOC	3.32 lbs/gal	**Recommended Dry Film Thickness**	1.5-2.0 mils
Ready to Spray Volume Solids (White)	53 %	**Physical Properties***	
Coverage @ 1 mil dry (white)	850 FT^2/gal	**Salt Spray 250 hours**	1/8" creep
Pot Life	7 Days	**Humidity 96 hours**	No Effect
		Flexiblity (1/8" conical mandrel)	Pass

AIP100,101,102,103	As Packaged		As Applied	
	Lb/Gal	**G/L**	**Lb/Gal**	**G/L**
Density	11.80	1414	11.33	1357
	% by Wt.	**% by Vol.**	**% by Wt.**	**% by Vol.**
Volatiles	28.2	47.2	32.0	52.0
Solids	71.8	52.8	68	48
Water	0	0	0	0
Exempt Compounds	0	0	5.3	9.1
	Lb/Gal	**G/L**	**Lb/Gal**	**G/L**
VOC Total	3.32	398	3.02	362
VOC Less Exempt	3.32	393	3.32	398
	Lb/Gal	**KG/L**	**Lb/Gal**	**KG/L**
HAPs	2.25	0.269	2.25	0.269

Using Mass Balance Method

Estimating Actual Emissions

lb/gal: (actual usage gallons) x (VOC content (lb/gal)) = VOC Emissions (lb/year)

% by wt: (actual usage pounds) x [VOC content (% by wt)/100] = VOC Emission (lb/year)

Estimating Potential Emissions:

Need to determine the maximum potential usage based upon equipment usage capability

Max Usage per year: **[(max hourly usage rate) * 8760]= lb/yr or gal/yr**

(2) If usage is reported in pounds, VOC content must be provided in % by weight. If usage is reported in gallons, VOC content must be reported in lb / gallon.

Water based Coatings

If using water based coatings, the water content should be subtracted from the paint usage total before calculating emissions.

(gal of coating used/year) x [1 – (% water by volume/100)] = gal of coating (less water)/year

(gal of coating (less water)/year) * (lbs VOC/gal of coatings (less water)) = lbs VOC /year

Calculate the pounds of VOC emitted using:

VOC Calculations (lb/yr): d = a x c

a=actual usage (gal/yr)

c=VOC Content (lb/gal)

If data sheet doesn't list VOC?

Calculate pounds of VOC per gallons of coating for each component

(% by Volume of each Comp) x (density of Comp (lb/gal)) = lbs Comp/gallon of coating

Sum all components listed on product data sheet

Calculate the pounds of VOC emitted using:

VOC Calculations (lb/yr): d = a x c

a=actual usage (gal/yr)

c=VOC Content (lb/gal)

Toxic Air Pollutant (TAP)?

Many products that contain VOC also contain Toxics Air Pollutants.

What is a TAP?

- those **pollutants** that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.

How do I know if a pollutant is a TAP?

- MCAPCO Part 1.5700 “Toxic Air Procedures” Subpart 1.5711 (Page 157-15)
- Air Toxics Inventory Pollutants List

MCAPCO 1.5703 “Definitions” states in part ….(22) “Toxic air pollutant” means any of those **carcinogens, chronic toxicants, acute systemic toxicants, or acute irritants** listed in MCAPCO…”

1.5711 EMISSION RATES REQUIRING A PERMIT

(a) A permit to emit toxic air pollutants shall be required for any facility where one or more emission release points are obstructed or non-vertically oriented whose actual rate of emissions from all sources are greater than any one of the following toxic air pollutant permitting emissions rates:

Toxic Air Pollutant (CAS Number)	Carcinogens	Chronic Toxicants	Acute Systemic Toxicants	Acute Irritants
	lb/year	lb/day	lb/hour	lb/hour
acetaldehyde (75-07-0)				6.8
acetic acid (64-19-7)				0.96
acrolein (107-02-8)				0.02
acrylonitrile (107-13-1)		0.4	0.22	
ammonia (7664-41-7)				0.68
aniline (62-53-3)			0.25	
arsenic and inorganic arsenic compounds	0.053			

Calculating TAP Emissions

Estimating Actual Emissions

lb/gal: (actual usage gallons) x (TAP content (lb/gal)) = TAP Emissions (lb/year)

% by wt: (actual usage pounds) x [TAP content (% by wt)/100] = TAP Emission (lb/year)

What if my usage is in gallons, but TAPs are in % by weight?

Convert % by weight to pounds of TAP per gallons of coating:

[% weight of TAP/100]x (density of Coating (lb/gal)) = lbs TAP/gal of coating

Example Calculations